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NOTES ON NEW ENGLAND HEPATICAE,—IX.

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EXCEPT in New Jersey and California the species of *Riccia* (in its restricted sense) have not been very diligently collected in North America. This has been true even in New England, where the distribution of the Hepaticae has been studied more thoroughly than in most other parts of the United States. Until about a year ago, when *R. sorocarpa* was reported from several localities,¹ *R. arvensis* was the only member of the genus definitely known to occur within our limits. During the past season, however, four additional species have been detected in Connecticut. Three of these, *R. Austini*, *R. dictyospora*, and *R. Lescuriana*, were found in or near New Haven, while the fourth, *R. hirta*, was found near Hartford. These four species, together with *R. arvensis*, are discussed in the present paper. Three other additions to the New England flora are likewise included. The first is *Nardia scalaris*, a species common in Europe but rare in America; the second is an *Odontoschisma* which European writers consider a variety of *O. denudatum* but which seems worthy of recognition as a distinct species; the third is *Anthoceros crispulus*, a species recently segregated from *A. punctatus*. At the close of the paper several additions to local state floras are enumerated.

1. *RICCIA ARVENSIS* Aust., Proc. Acad. Philadelphia for 1869: 232. Muddy shores of ponds and rivers, more rarely in fields. Rhode Island: listed in Bennett's Catalogue but without definite stations. Connecticut: Hartford (*E. B. Harger*); Wethersfield and West Hartford (*Miss Lorenz*); Orange and Middlefield (*A. W. E.*); East

¹ See Sheldon, *Bryologist* 13: 64. 1910. Also EVANS, *RHODORA* 12: 193. 1910.

Haven (*G. E. Nichols*). The species has been reported also from the following localities: Closter, New Jersey (*Austin*), where the original material was collected; near Hull, Quebec (*Macoun*); Ottawa, Ontario (*Macoun*); near Richmond, Staten Island, New York (*Howe*); Highlands, New Jersey (*Miss Haynes*); Lehigh Mountain, Pennsylvania (*Rau*); Georgetown, District of Columbia (*Coville*).

The color of *R. arvensis* is a dull grayish green, sometimes pigmented with purple along the margin. The older parts of the thallus often show a yellowish hue. Although the species sometimes forms rosettes 0.75–1 cm. in diameter, the plants frequently grow scattered or in irregular mats. Under unfavorable conditions the thallus is minute and unbranched, and specimens with mature capsules have been observed in which the entire plant was only 1 mm. long and 0.5 mm. wide. It is much more usual, however, for the thallus to fork from one to three times, and the branches when well developed measure 1.5–2 mm. in width and 2–3 mm. in length. The terminal branches are very bluntly pointed, rounded, or subemarginate at their extremities and bear on the upper surface a shallow median groove, occupying about one third the width of the thallus. This groove contracts abruptly at the apical end into a very narrow sulcus; toward the base of the branch it usually becomes more or less obliterated, especially after capsules are developed, the upper surface thereby appearing plane or nearly so. In some cases, however, the groove can be demonstrated, more or less clearly, almost to the base of the plant. From the sides of the groove the flanks of the thallus gently curve away, and the branches are bounded laterally by rounded ridges. The ventral scales do not extend beyond the margin; they are usually hyaline and inconspicuous but are sometimes tinged with purple. In most cases cilia are absent altogether. When present they are commonly scanty and poorly developed, being scarcely more than slightly projecting cells with rounded ends. In cross section the lower surface of the thallus is seen to be plane or a little convex in the median region, the sides rising obliquely or abruptly and meeting the upper surface at an angle of 90 degrees or less. The section is therefore approximately a rectangle or trapezoid. The thickness of the thallus is from one third to one half as great as the width. The epidermal cells are thin walled, rounded, and hyaline; they soon collapse and disappear more or less completely, the cells of the next layer then losing their chlorophyll and functioning as an epidermis.

The species is monoicous, and the capsules, which are abundantly produced, are irregularly scattered along the median portion of the thallus. At maturity they can readily be seen through the translucent tissues as a series of dark spots, and when the plants become dry the capsules protrude above the upper surface. The spores are dark brown and average about 85μ in diameter. All four faces are clearly reticulated, and a distinct wing $5-10 \mu$ wide is developed at the junction between the convex face and the three plane faces. The wing is yellowish brown and crispate, the margin being more or less crenulate and the surface minutely verruculose. On the convex face of the spore there are about eight meshes across the diameter, and the meshes measure about 10μ in width. In profile view the ridges which bound the meshes appear low but project at the angles of the meshes as truncate points, perhaps 5μ in length. The plane faces have lower ridges than the convex face but are otherwise much the same.

There seems to be little to distinguish *R. arvensis* from the European plant which is now usually known as *R. bifurca* Hoffm. This species was published in 1795,¹ but the original description is very incomplete and would apply equally well to a number of distinct plants. The type material is apparently no longer in existence. For these reasons the name *R. bifurca*, although it continued to be used by authors, had no definite signification until the end of the last century. As late as 1892 Camus,² in reviewing what was known about the species, pronounced it very badly understood and even hypothetical. It was not until 1898, when the subject was investigated by Heeg,³ that the species became defined in its present sense. He based his conclusions upon the specimens which Lindenberg,⁴ in 1836, referred to *R. bifurca*, but unfortunately even these specimens did not lead to definite results. In the fascicle labeled *R. bifurca*, Heeg found four distinct species and simply selected the one which seemed to him to coincide best with Lindenberg's description and figures. He reserved the name for this particular species and referred to *R. bifurca*, as thus restricted, a number of specimens from various localities in Sweden, Switzerland, and Austria. These he described clearly and fully. His conclusions

¹ Deutschlands Flora 2: 95. 1795.

² Bull. Soc. Bot. France 39: 229. 1892.

³ Bot. Not. 1898: 107.

⁴ Nova Acta Acad. Caes. Leop. Carol. 18: 425. pl. 20, f. 1. 1836.

soon became accepted by European writers, and *R. bifurca* is now recognized as a definite species throughout northern Europe. Whether or not the course pursued by Heeg was justifiable is a question. It would probably have been better if he had given up the name *R. bifurca* altogether and had chosen a new name for the species. At any rate it must be admitted that the present definition of *R. bifurca* is Heeg's and that it is very doubtful whether his conception of the species would agree with Hoffmann's or even with Lindenberg's. In case it should be proved beyond question that *R. arvensis* and Heeg's *R. bifurca* were identical, the writer suggests that the species should bear the name given it by Austin.

One of the closest allies of *R. arvensis* is apparently *R. glauca* L., a common European species which is known in North America from California only. This species is perhaps to be expected in the eastern United States. Its thallus differs from that of *R. arvensis* in having sharper margins and in being relatively thinner, the thickness being only one fourth as great as the width or even less. The spores of *R. glauca* are much like those of *R. arvensis*, except that the meshes of the convex face average a little larger.

2. RICCIA AUSTINI Steph., Bull. de l'Herb. Boissier 6: 336. 1898. *R. lamellosa* Aust., Hep. Bor.-Amer. 140. 1873 (not Raddi). *R. lamellosa*, var. *americana* M. A. Howe, Bull. Torrey Club 25: 189. 1898 (in part). On moist black earth in paths among rocks, sometimes in company with *R. Lescuriana* and *R. sorocarpa*. West Rock Ridge, Connecticut; first discovered in the town of New Haven (*G. E. Nichols*, 1911) and afterwards in the town of Woodbridge (*A. W. E.*). Since collected on South Mountain, Meriden, Connecticut (*Miss Lorenz*). The species was based on material collected by Austin near Closter, New Jersey, and issued as *R. lamellosa*. Its geographical distribution is very incompletely known. Underwood¹ reported *R. lamellosa* from Ontario, Alabama, and California, as well as from New Jersey, and the same species is listed without definite stations in Bennett's Plants of Rhode Island. The Californian material in the Underwood herbarium has since been described by Howe² as a distinct species under the name *R. americana*, but it is probable that some of the eastern specimens would now be referred to *R. Austini*. Unfortunately the question cannot be answered at the present time.

¹ Bot. Gaz. 19: 278. 1894.

² Mem. Torrey Club 7: 24. pl. 90. 1899.

The true *R. lamellosa* is a species of the Mediterranean region, and all records of its occurrence in North America need careful investigation.

The thallus of *R. Austini* is of a pale glaucous green color and is apparently never pigmented with purple. It sometimes forms a complete rosette about 1.5 cm. in diameter but often fails to do so, and the plants then occur irregularly scattered or in more or less compact mats. The thallus forks from one to three times, the branches measuring 1.5–3 mm. in width and 3–4 mm. in length. The terminal branches taper gradually to blunt points. On the upper surface in the apical region a deep and narrow sulcus is visible, from which the flanks curve abruptly away. The sulcus is usually very short and the older parts of the thallus are plane or nearly so. The ventral scales are large, crowded and hyaline and project considerably beyond the margin of the thallus, thus forming a distinct translucent border. The margins of the scales are either entire or minutely and irregularly crenulate from projecting cells. The plant is quite destitute of marginal or surface cilia. In cross section the lower surface appears plane or slightly convex in the median region, while the sides ascend obliquely and meet the upper surface at a sharp angle of about 60 degrees. The thickness of the thallus is usually from one fourth to one third as great as the width. The epidermis consists of colorless and rounded thin-walled cells, which soon break down. Their place is taken by the second series of cells, which gradually lose their green contents but retain their thin walls.

Although the species is monoicous the capsules are not abundantly produced. In fresh material they are completely hidden until the tissue above them begins to discolor and to become disintegrated. The spores are brown and measure 85–100 μ in maximum diameter. The angles between the faces of the spore are rounded, and there is no wing developed at the junction between the convex face and the three triangular faces. The convex face is covered over with anastomosing ridges about 2 μ high, which form a distinct reticulum, and the ridges do not project appreciably at the angles of the meshes. The latter number about nine across the face of the spore and average about 10 μ in width. The triangular faces are marked with still lower ridges, irregularly arranged and not forming a network.

The three related species, *R. Austini*, *R. americana*, and *R. lamellosa*, form a definite group characterized by a flat thallus destitute of cilia

but bordered by a series of imbricated, hyaline scales. The spores in the two American species afford the best differential characters in separating them from *R. lamellosa*, in which a distinct wing is developed at the junction between the convex face of the spore and the three plane faces. The absence of a wing in the American plants which had been referred to *R. lamellosa* was first pointed out by Underwood.¹ The spores in the true *R. lamellosa* are further distinguished from those of *R. Austini* by their slightly larger size (90–120 μ according to Müller²) and by the fact that all four faces are reticulated. In *R. americana*, also, the spores are larger than in *R. Austini*, measuring 90–126 μ according to Howe, and the meshes of the convex face are likewise larger, averaging about 15 μ in width. The thallus has even more conspicuous scales than in the eastern plant and is slightly more robust, measuring 2.5–4 mm. in width. Howe's figures of *R. americana* should be carefully consulted in studying *R. Austini*.

3. RICCIA DICTYOSPORA M. A. Howe, Bull. Torrey Club 28: 163. 1901. On moist black earth in a path among rocks, in company with *R. sorocarpa* and *Grimaldia fragans*. West Rock Ridge, Woodbridge, Connecticut (A. W. E.). New to New England. Known from only two other stations, namely: Athens, Georgia (*R. M. Harper*), the type locality, and Glencoe, Missouri (*N. L. T. Nelson*). A portion of the original material, kindly communicated by Howe, agrees closely with the specimens from Connecticut, except that the spores are a little larger.

In *R. dictyospora* the color is a more decided green than in either of the preceding species and is only slightly glaucous. The plants sometimes form irregular rosettes 1.5–2 cm. in diameter but are much more likely to grow in intricate mats or irregularly scattered. The thallus is narrow, measuring about 1 mm. in width, and the branches are mostly 2–3 mm. long. They tend to spread less widely than in most species of *Riccia*. The terminal branches have rounded or slightly emarginate apices. Near the tip a narrow median sulcus can be demonstrated, but this extends backward for a short distance only, the older parts of the thallus being plane or nearly so on the upper surface. The thallus is destitute of marginal hairs but bears a series of ventral scales, which extend slightly beyond the margin. These are usually deeply pigmented with purple and form a narrow

¹ Bot. Gaz. 19: 274. 1894.

² Rabenhorst's Kryptogamen-Flora 6: 187. 1907.

border visible from above. As seen in cross section the lower surface is convex in the median region, the sides rising obliquely and meeting the upper surface at a sharp angle. The thickness of the thallus is usually about half as great as the width. The epidermal layer is composed of thin-walled rounded cells without chloroplasts. These soon collapse and either disappear completely or persist as cup-shaped vestiges. In most cases the second layer of cells, which are likewise rounded and thin-walled, remains intact and assumes the functions of an epidermis.

The plants are monoicous. The capsules are sparingly produced and are difficult to discover until the tissue above them has become broken down. The spores are brown and average about $100\ \mu$ in diameter in the type specimen and about $90\ \mu$ in the Connecticut material. They agree with the spores of *R. Austini* in having no wing developed at the junction between the convex face and the three plane faces. The whole surface is covered over with a distinct reticulum which is not interrupted even at the rounded angles of the spore. The reticulum is formed by a system of low ridges which project at the angles of the meshes as truncate papillae. These papillae, as Howe shows, are $6-9\ \mu$ long on the convex face of the spore and only $4-5\ \mu$ on the triangular faces. He brings out the fact also that the meshes on the convex face measure $8-12\ \mu$ in diameter, while those on the other faces are slightly larger. Howe's account of the species is so full that the above description adds no new points of importance.

The remarkable spores of *R. dictyospora* will serve to distinguish the species from most of the other members of the genus. In size and general appearance the plant bears considerable resemblance to *R. sorocarpa*, in which the thallus bears a similar narrow sulcus in the apical region. In *R. sorocarpa*, however, the sulcus is even sharper, and the color of the plant is more distinctly glaucous. The species is further distinguished by its delicate and hyaline ventral scales and by its very different spores, which measure $70-90\ \mu$ in maximum diameter and develop a distinct though narrow wing. In *R. nigrella* DC. the thallus agrees with that of *R. dictyospora* in being bordered by a series of slightly projecting purple scales. The spores, however, are smaller, measuring $60-80\ \mu$, and are further characterized by the presence of a narrow wing. *R. nigrella* is widely distributed in southern Europe and in North America is definitely known from California. According to Austin it occurs also in New York and Pennsylvania,

but no recent collections of the species have been made in the eastern United States.

4. *RICCIA HIRTA* Aust., Proc. Acad. Philadelphia for 1869: 232 (as synonym). Underwood, Bot. Gaz. **19**: 274. 1894. *R. arvensis*, var. *hirta* Aust., Proc. Acad. Philadelphia for 1869: 232. In the bed of an old canal. West Hartford, Connecticut (*Miss Lorenz*, 1911). New to New England. The species has a confused history and its range is very incompletely known. It was based on specimens collected by Austin at Closter, New Jersey, and distributed in his Hep. Bor.-Amer. *142* as a variety *hirta* of *R. arvensis*. When Underwood raised the variety to specific rank he associated with it specimens from California and drew his account of the spores largely from these specimens. The Californian plant was soon afterwards described as a distinct species by Howe under the name *R. trichocarpa*,¹ thus leaving nothing except the New Jersey plant to represent the true *R. hirta*. According to Howe the material issued under *No. 142* is not homogeneous, some of it being clearly *R. Lescuriana*, but in the set of Hep. Bor.-Amer. examined by the writer the specimens under this number seem to be free from admixture and agree very well with those from Connecticut. They agree also in most respects with the description of *R. hirta* given by Stephani,² assuming that his spore-measurements are increased 20 per cent., as Schiffner³ suggests. Stephani records the species from Louisiana (*Langlois*), as well as from New Jersey.

The Connecticut specimens of *R. hirta* do not form rosettes but grow in intricate mats. The color is a grayish green, much like that of *R. arvensis*, and the margin is sometimes tinged with purple. An individual thallus is occasionally simple but is usually once to three times dichotomous. It measures 1-1.5 mm. in width, and the branches are mostly 2-3 mm. long. The terminal branches are rounded at the extremity and show a very narrow but shallow median sulcus which extends back from the apex for a distance of about a millimeter. At the basal end the sulcus is usually abruptly obliterated but occasionally widens out into a very short groove. The older parts of the thallus are plane or nearly so on the upper surface. The ventral scales are hyaline and inconspicuous and do not extend beyond the margin. The cilia or hairs, which give the species its

¹ Bull. Torrey Club **25**: 184. pl. 337. 1898. Mem. Torrey Club **7**: 17. pl. 88. 1899.

² Bull. de l'Herb. Boissier **6**: 317. 1898.

³ Lotos 1901: [7].

name, are not numerous. They are mostly confined to the margin but a few sometimes appear scattered over the upper surface. Those on the margin occur singly or in pairs. The cilia are whitish and usually sharp-pointed and have a length of 0.07–0.15 mm. In cross section the lower surface appears more or less convex in the median region, while the sides rise obliquely and meet the upper surface at a sharp angle of about 60 degrees. The thickness of the thallus is from one third to two thirds as great as the width. The epidermis is much the same as in *R. arvensis*.

The species has a monoicous inflorescence and produces an abundance of capsules, which show more or less clearly through the translucent tissue above them. The mature spores are brown and measure 85–100 μ in maximum diameter. At the junction between the convex face and the three plane faces a narrow wing 5 μ or less wide is developed, and this wing is indistinctly crenulate and very minutely verruculose. The convex face is covered with a regular reticulum, the meshes numbering about seven across the diameter and measuring about 12 μ in width. At the angles of the meshes the bounding ridges project as short and rounded protuberances. On the triangular faces of the spore the ridges are lower than on the convex face; they sometimes form an incomplete reticulum but are usually vermicular and unconnected.

Although a strong superficial resemblance exists between *R. hirta* and *R. arvensis* it is not difficult to distinguish them. The cilia of *R. hirta* afford the most striking difference, the thallus of *R. arvensis* being usually smooth throughout. European writers, however, have shown that cilia occur exceptionally in species which are usually smooth and that they are sometimes absent in species which are usually ciliate. It is therefore unwise to emphasize too strongly a difference derived from the presence or absence of cilia alone. Fortunately *R. arvensis* and *R. hirta* show other differences of a more trustworthy character. In *R. arvensis*, for example, the upper surface of the thallus bears a broad median groove, while in *R. hirta* it usually bears a narrow sulcus only. *R. arvensis* is further distinguished by its slightly smaller spores, reticulate on all four faces; in *R. hirta* the reticulum is usually distinct on the convex face only. In *R. trichocarpa*, according to Howe, the spores are more opaque and slightly larger than in *R. hirta*, the margins of the thallus are rounded rather than acute, and the cilia are much more numerous and longer, attaining a length of 0.3–0.65 mm.

5. RICCIA LESCURIANA Aust., Proc. Acad. Philadelphia for 1869: 232. *R. glaucescens* Carringt., Grevillea 8: 41. 1879. On moist black earth in paths among rocks, in company with *R. Austini* and *R. sorocarpa*. West Rock Ridge, New Haven, Connecticut (*G. E. Nichols*, 1911). New to New England. The original material of *R. Lescuriana* was collected by Austin near Closter, New Jersey, and distributed in Hep. Bor.-Amer. 143. The species has since been recorded from Jacksonville, Florida (*J. D. Smith*), from Fort Ross, California (*M. A. Howe*), and from Illinois (on the authority of Austin). In 1898 Heeg¹ reported its occurrence in Europe, citing specimens from numerous localities, and reduced *R. glaucescens* to synonymy.

In its most typical condition *R. Lescuriana* forms rosettes 1.5–2 cm. in diameter, but the plants more frequently grow irregularly scattered or in indefinite mats. Their color is green when fresh with a somewhat glaucous cast, much less marked, however, than in *R. Austini* and *R. sorocarpa*. As the plants grow older they sometimes become more or less tinged with yellow. The margin is often the same color as the rest of the upper surface but is occasionally pigmented with purple, and purple spots usually appear over the capsules as they approach maturity. The thallus forks from one to four times, the branches measuring 2–3 mm. in width and about 3 mm. in length. The terminal branches are rounded or bluntly pointed at the apex; on the upper surface they show a shallow median groove about one third the width of the thallus, bounded on each side by a rounded ridge. The groove is usually about a millimeter in length; at its apical end it becomes abruptly obliterated through the convergence of the lateral ridges; toward its basal end it gradually becomes flattened out, leaving the older portions of the thallus plane or nearly so. The ventral scales do not extend beyond the margin; they are commonly hyaline and inconspicuous but sometimes show a purple pigmentation. Near the margin of the thallus several series of cilia can often be demonstrated. They average about 0.15 mm. in length and are usually bluntly pointed. According to Heeg these cilia are short-lived and are sometimes scanty or absent altogether. In the West Rock specimens they are very well developed, and their presence is emphasized by Austin in his original description. He even describes two varieties, *cruciata* and *trichotoma*, based largely on differences in the

¹ Bot. Not. 1898: 111.

length of the cilia. In cross section a convex median region becomes apparent on the lower surface of the thallus, the sides rising obliquely and meeting the upper surface at an angle of 90 degrees or somewhat less. The thickness of the thallus is from one third to one half as great as the width. The epidermal cells are thin-walled and hyaline, the shape varying from broadly ellipsoidal to pyriform. They soon collapse and disappear, but the cells of the next layer then become hyaline also and apparently act as an epidermis.

The inflorescence is monoicous but the capsules are not always abundant. The spores are brown and average about $100\ \mu$ in diameter. The convex face develops a regular reticulum with about eight meshes across the diameter, the individual meshes measuring about $12\ \mu$ in width. The ridges bounding the meshes are very low but sometimes project slightly at the angles as truncate or rounded papillae. Between the convex face and the three plane faces a narrow hyaline wing, $2\text{--}10\ \mu$ wide, is formed, the margin of which is minutely and irregularly crenulate. The plane faces are marked with still lower ridges than the convex face; in most cases they scarcely anastomose, but sometimes a more definite reticulum is formed.

Lindberg¹ referred *R. Lescuriana* as a synonym to *R. Michelii* Raddi, a species of southern Europe, which has since been described in detail and figured by Levier.² The two species are, indeed, very closely related, and Müller³ emphasizes the fact that the ciliate form of *R. Lescuriana* can be distinguished from *R. Michelii* only with difficulty. Apparently the median groove extends farther backward in *R. Michelii* than in *R. Lescuriana*, and the epidermal cells are rarely or never pyriform. The most important difference between the two species, however, is in the inflorescence, *R. Michelii* being dioicous and *R. Lescuriana* monoicous. Among the species of the eastern United States *R. arvensis* bears some resemblance to *R. Lescuriana* and agrees with it in having a broad median groove on the upper surface of the thallus. But *R. arvensis* is a smaller plant, more glaucous in appearance, and its spores are smaller and more regularly reticulated on the plane faces.

6. NARDIA SCALARIS (Schrad.) S. F. Gray, Nat. Arr. British Pl. 1: 694. 1821. *Jungermannia scalaris* Schrad., Syst. Samml. Krypt.

¹ Musc. Scand. 2. 1879.

² Bull. de l'Herb. Boissier 2: 229–240. pl. 5. 1894.

³ Rabenhorst's Kryptogamen-Flora 6: 176. 1907.

Gewächse 2: 4. 1797. *Mesophylla scalaris* Dumort., Comm. Bot. 112. 1822. *Alicularia scalaris* Corda; Opiz, Beitr. zur Naturk. 1: 652. 1829. On rocks. Eastport, Maine (*A. W. E.*, 1911). New to New England. Although *Nardia scalaris* is so abundant in northern Europe, only a few records of its occurrence in North America have been published. The writer is now able to cite the following localities for the species, several of which have already been noted elsewhere: ¹ Greenland, according to C. Jensen; Battle Harbor, Labrador, and Lantern Cove, Newfoundland (*Waghorne*); Arichat, Cape Breton, Nova Scotia (*O. D. Allen*); Campobello Island, New Brunswick (*Farlow*); Dawson, Yukon (*Williams*); Yes Bay, Alaska (*Howell*); Juneau, Alaska (*Brewer and Coe*); Nanaimo, British Columbia (*J. Macoun*); Port Renfrew, British Columbia (*Miss Gibbs*); Mt. Ranier, Washington (*O. D. Allen, Foster, Flett*); Olympic Mountains, Washington (*Frye*). The specimens from Nova Scotia and New Brunswick grew on low cliffs by the sea, and those from Eastport were collected in a similar habitat. The plants formed dense mats, scarcely ten feet above high water mark and only a few feet below the edge of the woods.

The species is dioicous and most of the material from North America is completely sterile. The shoots are normally prostrate but become suberect when growing in compact masses. On account of their rotund undivided leaves, usually imbricated and concave, the plants bear a considerable resemblance to such species as *N. crenulata* and *Jungermannia sphaerocarpa*. They can be at once distinguished, however, by their small but persistent underleaves, which are lanceolate or subulate in form and taper out to slender points. These underleaves show clearly, even when a shoot is viewed from one side, because they are not closely appressed to the stem but spread out from it at the base almost at right angles. The leaf-cells have small but distinct trigones and each encloses a small number of large and glistening oil-bodies with a smooth surface. These peculiarities will also assist in distinguishing the species.

The closest relative of *N. scalaris* is *N. Geoscyphus* (DeNot.) Lindb., known in New England from New Hampshire and Massachusetts.² This species being paroicous is frequently fertile. The plants rarely occur in dense mats, so that the shoots are usually prostrate and

¹ See especially Macoun, Cat. Canadian Pl. 7: 12. 1902.

² See EVANS, RHODORA 9: 57. 1907.

closely adherent to the soil. The leaves, although sometimes undivided, are often bifid, and in the variety *insecta* most of the leaves show the bifid character. The underleaves, although present, are often short-lived and difficult to demonstrate. The trigones in the leaf-cells are usually smaller than in *N. scalaris* and the oil-bodies are less conspicuous on account of their granular surface. Unfortunately in both species the oil-bodies lose their peculiarities in old material, and sometimes disappear completely from specimens which have been long preserved.

7. **Odontoschisma elongatum** (Lindb.) sp. nov. *O. denudatum*, var. *elongatum* Lindb., Not. Soc. F. et Fl. Fenn. **13**: 361. 1874. In bogs on the margins of ponds. Maine: Upper Wilson Pond, near Greenville, Maine (*A. W. E.*, 1911). New Hampshire: Lower Greeley Pond, Waterville (*Miss Lorenz*, 1908). Specimens from Scoresby Sound, Greenland, collected by N. Hartz in 1892 and listed by C. Jensen¹ as *O. denudatum*, also belong here. The species likewise occurs mixed with the type material of *O. Macounii*, collected in 1869 by Macoun in the Lake Superior region of Ontario. Lindberg's variety *elongatum* was based on a series of specimens from Iceland, Lapland, and Finland. Among these was one collected by Ångström at Lycksele in Lapland and distributed by Gottsche and Rabenhorst, under the name *Sphagnoecetis communis*, in their *Hep. Europ.* 440. This specimen, which agrees fully with the American specimens noted above, may be considered the type of *O. elongatum*. According to published records the species grows also in northern Germany,² in the Faroe Islands,³ in Scotland,⁴ and in Austria.⁵ One of the Austrian specimens cited was collected by Breidler near Mitterdorf in Styria and distributed in *Flora Exsic. Austro-Hungarica* 2340. Unfortunately this plant (of which the writer owes an example to the kindness of Miss Haynes) does not agree with Lindberg's type and should not be included under *O. elongatum*. The other Austrian specimens reported should therefore be further investigated.

Although *O. elongatum* sometimes grows mixed with *Sphagnum* and other bryophytes, it often forms large mats which are free from admixture. The type specimen is associated with *Lophozia inflata*

¹ Meddel. om Grønland **15**: 369. 1898.

² Warnstorf, *Kryptogamenfl. der Mark Brandenburg* **1**: 238. 1902.

³ C. Jensen, *Bot. of Færøes* **1**: 125. 1901.

⁴ Macvicar, *Jour. Bot.* **43**: 118. 1905.

⁵ Breidler, *Mitt. Naturw. Ver. Steiermark* **30**: 335. 1894.

(Huds.) M. A. Howe, and it is interesting to note that the same species occurs in connection with the material from New Hampshire. The color of *O. elongatum* is sometimes a bright green, but a yellowish or brownish pigmentation is usually present and a deep blackish purple hue is not uncommon. The shoots at first produce branches very sparingly, and the long unbranched ascending axes are a striking feature of the species. As the stems become prostrate with their increase in length, branches of the usual intercalary kind are produced, some lateral in position and some ventral. Among the latter, as in other members of the genus, a few show a flagelliform character and grow downward, holding the plant firmly in place. Except on these specialized branches rhizoids are sparingly developed.

The orbicular leaves, which usually measure 0.5–0.7 mm. in diameter, are sometimes distant but more frequently contiguous or imbricated. In most cases they are distinctly concave. The leaf-cells average about 20 μ along the margin and about 23 μ in the median and basal portions of the leaf. The marginal cells sometimes form an indistinct border, but the texture of the leaves is usually uniform throughout. When the trigones are well developed they are orbicular and project into the cell-cavities; when poorly developed they may be triangular with concave sides.

Lindberg considered his variety *elongatum* poorly supplied with underleaves, but they are really better developed than in most species of *Odontoschisma* and often acquire a size of 0.2×0.15 mm. They are not very definite in outline but tend to be ovate from a broad base. In some cases they may be shortly bidentate at the apex but this condition is far from constant; occasionally an indistinct lateral tooth is present. Slime papillae are unusually abundant; they occur not only along the margin but also on the surfaces, being especially numerous on the upper or inner surface. The writer¹ has already called attention to the constant presence of underleaves in *Odontoschisma* and has emphasized the fact that they yield specific characters of importance. Unfortunately, on account of their fragility, they are often overlooked. A clear idea of them can be readily obtained by dissecting off the tip of a vigorous shoot, mounting it in the usual way, and then crushing it by a gentle rubbing pressure on the cover-glass. In this way the underleaves can be separated from the other parts and examined by themselves. Since

¹ Bot. Gaz. 36: 330. 1903.

they acquire their characteristics while still close to the growing point, the underleaves secured in this way will give a better idea of their true structure than the weathered underleaves dissected from the older parts of a shoot.

The male plants of *O. elongatum* have not yet been observed, but the inflorescence is evidently dioicous. The female branches are sometimes ventral and sometimes lateral. They are usually very short but are occasionally somewhat elongated. Their leaves, however, are always more or less modified. The bracts proper are in two or three pairs. Those next the perianth, which are of course the most characteristic, are typically ovate and bifid for one third to one half their length, showing a narrow sinus and acute lobes. Their margins are irregularly crenate or dentate, and sometimes one or two basal lobes or divisions are present. The corresponding bracteole is much like the bracts, except that its divisions are blunter and less definite. Deviations from these typical conditions are not infrequent, the lobes of the bracts being sometimes short and blunt and the bracteole sometimes showing little or no indication of an apical sinus. The tendency to vary in this way becomes even more apparent in the other bracts and bracteoles, several of which may be quite undivided at the apex. Unfortunately mature perianths of *O. elongatum* are still unknown. In the very immature perianths found in unfertilized flowers the mouth is slightly and irregularly lobed and the margin is finely crenulate from projecting cells. These peculiarities doubtless persist until maturity.

Gemmae are comparatively rare in the present species, and many tufts fail to show them altogether. The gemmiparous shoots are suberect and much resemble those of *O. denudatum*, except that they are usually shorter, the development of the gemmae leading more rapidly to the limitation of their growth. In most cases the transition between normal leaves and gemmiparous leaves is very abrupt, but it is sometimes more gradual and a few cases have been observed in which a shoot recovered from the tendency to form gemmae and developed new normal leaves. The gemmae themselves, which measure about $25 \times 33 \mu$, are oval, two-celled bodies with delicate walls.

One of the closest allies of *O. elongatum* is *O. Macounii* (Aust.) Underw., and it is possible that Austin did not distinguish clearly between them when he published his description of the latter plant.

In commenting upon the type-material of this species the writer¹ called attention to the fact that it consisted of an admixture composed of a pale plant with gemmae and a more or less pigmented plant without gemmae. It was recommended that the pale material, from which the original description was evidently largely drawn, should be considered the actual type of the species. With regard to the pigmented material judgment was withheld, although the possibility was suggested that it might perhaps represent a divergent form of *O. Macounii*. It now appears, as noted above, that this pigmented material represents *O. elongatum*. The species agrees with *O. Macounii* in its concave leaves and relatively large underleaves. Its leaves, however, are less densely imbricated, the leaf-cells have smaller trigones, the slime papillae on the surface of the underleaves are more numerous, the gemmiparous shoots are shorter, their leaves are smaller, and the gemmae themselves have thinner walls. In *O. denudatum*, which also is closely related, the plants are somewhat more robust than in *O. elongatum*, and the plants are frequently pigmented with reddish, a type of coloration which the new species apparently never shows. *O. denudatum* is further distinguished by its smaller underleaves (on shoots with normal leaves), by the absence of surface papillae, and by the more acuminate divisions of the perichaetial bracts. The leaf-cells are much the same in the two species, and the similarity in the gemmiparous shoots has already been mentioned.

8. ANTHOCEROS CRISPULUS (Mont.) Douin, Rev. Bryol. **32**: 27. f. 1-15. 1905. *A. punctatus*, β . *multifidus* Nees, Naturgeschichte der europ. Lebermoose **4**: 340. 1838. *A. punctatus*, α . *crispulus* Mont.; Webb & Berthelot, Hist. Ins. Canar. Bot. **2**⁴: 64. 1840. On moist earth along roadsides. Andover and West Hartford, Connecticut (*Miss Lorenz*, 1911). Not before recorded from North America. Although *A. crispulus* was included by Nees von Esenbeck among the varieties of *A. punctatus* L., he recognized some of its most important characteristics and intimated that it might perhaps represent a distinct species. Douin, however, was apparently the first one to raise it definitely to specific rank. His description and figures were drawn from specimens collected in the department of Eure-et-Loir, in France, and the species has since been reported by C. Müller² from various scattered localities in Germany. It will probably be found

¹ Bot. Gaz. **36**: 321. 1903.

² Beih. zum Bot. Centralbl. **22**²: 253. 1907.

to have a wide distribution in Europe. In addition to the synonyms quoted above Douin gives *Anthoceros multifidus* L., Sp. Plant. 1140. 1753. If this were actually the same plant the species should of course bear the Linnaean name. *A. multifidus*, however, was based upon a non-binomial species of Dillenius, which Lindberg,¹ after examining the type in the Dillenian herbarium, pronounced the same as *Riccardia multifida* (L.) S. F. Gray (*Jungermannia multifida* L.). *A. multifidus*, therefore, becomes reduced to synonymy and the name is not available for future use. The type specimen of Montagne's variety was collected in the Canary Islands, and Douin does not state whether or not he had examined it personally.

The differences between *A. punctatus* and *A. crispulus* are brought out very clearly by Douin, and the following notes are drawn entirely from his paper. Both the thallus and the capsule yield differential characters. In *A. punctatus* the thallus is only slightly lobed; in *A. crispulus* the lobing is much more extensive, the lobes arising from the surface of the thallus as well as from the margin, thus giving it a strongly crispate appearance. In *A. punctatus* the capsule is from thirty to forty times as long as wide at the time of dehiscence; in *A. crispulus* it attains a length of from fifty to seventy times the width. In *A. punctatus* the pseudo-elaters are usually only one or two cells long and apparently never exceed a length of three cells; in *A. crispulus*, although short pseudo-elaters occur in abundance, much longer ones are also present, some of them being from four to nine cells in length. Both species bear dark colored spores, roughened, especially on the convex face, by numerous sharp or furcate papillae.

The additions to local state floras, not already mentioned, are as follows:—

For Maine. *Bazzania tricrenata*; Greenville (A. W. E.). *Calypogeia Neesiana*; Upper Wilson Pond, near Greenville (A. W. E.). *Lejeunea cavifolia*; Greenville (A. W. E.). *Lophozia excisa*; Lubec (A. W. E.). *Radula tenax* and *Sphenobolus exsectus*; Greenville (A. W. E.).

For New Hampshire. *Calypogeia Neesiana*; Waterville (Miss Lorenz). *Cephalozia connivens*; Waterville (A. W. E.). *Cephaloziella Hampeana*; various localities in the White Mountains (W. G. Farlow, Miss Lorenz, A. W. E.)² *Leucolejeunea clypeata*; opposite Brattle-

¹ Krit. Gransk. 37. 1883.

² The determinations of the *Cephaloziellae* in this list were mostly made or confirmed by Professor Douin, of Chartres.

boro (*J. W. Russell*, 1844), specimen communicated by L. W. Riddle.

For Vermont. *Metzgeria pubescens* and *Riccardia palmata*; Jamaica (*F. Dobbin*). *Cephaloziella Hampeana*; Jerico (*A. W. E.*). *C. myriantha*; Killington Peak (*E. H. Lorenz*).¹ *Porella rivularis*; Jamaica (*F. Dobbin*). *Radula obconica*; Salisbury (*Miss Lorenz*).

For Massachusetts. *Calypogeia Neesiana*; Reading (*C. C. Kingman*). *Cephalozia serriflora*; West Harwich (*C. A. Weatherby*).² *Cephaloziella Hampeana*; Nahant (*W. G. Farlow*). *Lophozia porphyroleuca*; Mt. Greylock, Adams (*A. LeR. Andrews*).

For Rhode Island. *Calypogeia tenuis* and *Cephaloziella elachista*; Hopkinton (*A. W. E.*). *C. myriantha*; Wickford (*A. W. E.*). *Lepidozia sylvatica*; Westerly and Hopkinton (*A. W. E.*). *Lophozia excisa*; Hopkinton (*A. W. E.*). It should also be noted that the Rhode Island records from *Riccardia pinguis* and *Cephalozia lunulaefolia* may now be marked with the sign "+," the necessary specimens having been collected by the writer.

For Connecticut. *Calypogeia Neesiana*; Ledyard and Stonington (*A. W. E.*). *Lophozia alpestris* and *Sphenolobus Hellerianus*; Salisbury (*A. W. E.*).

The census of New England Hepaticae now stands as follows: Total number of species recorded, 169; number recorded from Maine, 116; from New Hampshire, 128; from Vermont, 103; from Massachusetts, 90; from Rhode Island, 71; from Connecticut, 128; common to all six states, 47.

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NOTES ON THE FLORA OF DUXBURY, MASSACHUSETTS.

CLARENCE H. KNOWLTON.

THE Committee which is working on the Flora of the Boston District has had very little information from the southern, and especially the southeastern towns. Except for the Blue Hills and the high land in Sharon and vicinity, this section of country is very flat, rising from sea-level in the east to a height of about 300 feet in Belling-

¹ See Grout, *Bryologist* 14: 53. 1911.

² Miss Greenwood reports this species from Worcester (*Bryologist* 13: 8. 1910), but her record was based on specimens which the writer would refer to *C. lunulaefolia*.